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AV SEQUENTIAL ELECTROSTIMULATION IN PATIENTS WITH CARDIOGENIC SHOCK AND AV BLOCK III* DUE TO PREDOMINANT RIGHT VENTRICULAR MYOCARDIAL INFARCTION

G. Voga, I. Žuran, B. Krivec, F. Škrabl-Močnik, R. Skale

In patients with predominant right ventricular infarction sinus rhythm is especially important to preserve atrial systole because of adequate right ventricular filling. Although beneficial hemodynamic influence of AV sequential pacing was reported in some previous studies, this method is not being routinely used in the acute infartion setting.
We used AV sequential pacing in 7 patients with acute inferior myocardial infarction and right ventricular involvement. Predominant right ventricular failure was confirmed by CVP, being equal or greater than PAOP. In all patients ventricular pacing (70 - 80/min) was started on admission because of AV block III*. Cardiogenic shock with typical clinical signs, oliguria (< 20 ml/h) and lactic acidosis developed in all patients between first and fifth day of hospital stay. Shock was refractory to volume loading with plasma expanding agent (until PAOP 18 mm Hg was reached), inotropic drugs (dopamin 6 - 12 mcg/kg/min and dobutamin 4 - 18 mcg/kg/min in all patients, norepinephrine 0.2 mcg/kg/min in 2 patients), and controlled mechanical ventilation in 3 patients. After AV sequential pacing (70 - 80/min, AV interval 150 - 180 ms) was employed instead of ventricular; we observed significant and immediate increase in cardiac index from mean value 1.9 l/min/m^2 (range 1.6 - 2.4 l/min/m^2) to 2.7 l/min/m^2 (range 2.2 - 3.1 l/min/m^2). CVP and PAOP were not significantly altered. In one patient atrial stimulation was not efficient despite the proper position of electrode, and he died in cardiogenic shock. Signs of shock disappeared in 6 patients, 5 patients survived and were discharged. One patient died after the sinus rhythm was recovered because of sudden refractory left ventricular failure.
We conclude that AV sequential pacing significantly improves cardiac output in patients with predominant right ventricular infarction, AV block III* and cardiogenic shock. We believe that it should be routinely used in such patients even before inotropic drugs.

Department of Intensive Internal Medicine, General Hospital, Kersnikova 1, 63000 Celje, SLOVENIA

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LONG-TERM EFFICACY OF DUAL-CHAMBER PACING IN DRUG-RESISTANT IDIOPATHIC DILATED CARDIOMYOPATHY

M. Hochleitner, H. Hörtnagl, H. Hörtnagl, F. Gschnitzer

In a longitudinal study up to 5 years the long-term efficacy of physiological dual-chamber (DDD)-pacing in the treatment of drug-resistant idiopathic dilated cardiomyopathy was evaluated in 17 patients. The considerable clinical improvement achieved after implantation of a pacemaker programmed for DDD-pacing was maintained throughout the observation period or until death. Within 5 years after onset of DDD-pacing 4 patients received donor hearts and 8 patients died unexpectedly at home due to sudden death of undefined origin or after a thromboembolic event. In one patient the cause of death was an adenocarcinoma and 3 patients survived the observation period and are still in good clinical condition. In none of the patients hospitalization for worsening heart failure was necessary. The mean survival time was 25 ± 6 months.
Only within the first months an interruption of pacing in DDD-mode for 2 to 4 hrs was followed by a marked decrease in left ventricular ejection fraction and an increase in cardiac thoracic ratio and echocardiographic dimensions, whereas after prologed treatment almost no changes in these parameters were observed.
The present data indicate that DDD-pacing can be applied successfully up to several years. By this approach a progressive improvement in cardiac function and in diminuition of the dilatation of the left ventricle can be achieved.

Department of Medicine, University Hospital Innsbruck, Anichstraße 35, A-6020 Innsbruck, Austria

Pressure controlled ventilation in ARDS

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PRESSURE CONTROLLED WITH INVERSE RATIO VENTILATION IN PATIENTS WITH ADULT RESPIRATORY DISTRESS SYNDROME (ARDS)

M. Lessard, E. Guerot, C. Mariette, A. Harf, F. Lemaire, L.Brochard

Pressure controlled inverse ratio ventilation (PCIRV) has been proposed to be used in patients with ARDS instead of volume controlled ventilation with PEEP (VCV). The use of PCIRV, however, is made uneasy by the fact that monitoring of delivered volume and of the level of intrinsic PEEP is necessary. We thus compared in this study VCV, pressure controlled ventilation (PCV) both with a standard I/E ratio (½) and PCV with inverse ratio of *2/1* (PCIRV) in nine patients with ARDS (PaO_2/FiO_2 = 158 ± 57 mmHg with PEEP = 12 ± 1 cmH_2O). The setting of the ventilator was adjusted in order to obtain the same level of PEEPi, the same V_T and breathing frequency and the same FiO_2 in the three modes of ventilation.

	VCV	PCV	PCIRV	p
PaO_2 (mmHg)	109±9	107±8	91±8	<0.001
$PaCO_2$ (mmHg)	61±5	61±5	58±6	0.06
Shunt (%)	29.3±3.5	29.7±3.4	31.7±3.7	0.07
MAP (mmHg)	72±4	72±4	66±4	<0.01

No difference was noted between the three modes concerning static pressures, lung compliance (38 ± 5 ml/cmH_2O) and ventilation. Mean airway pressure and mean alveolar pressure was higher with PCIRV despite a lower peak airway pressure. With PCIRV a significant decrease in PaO_2 was observed with a small decrease in $PaCO_2$. A significant drop in systolic and mean arterial pressure was also present during PCIRV, without other significant hemodynamic alterations.

Conclusion : in this short term study no benefit of PCV or PCIRV could be demonstrated over a more conventional approach.

Medical Intensive Care Unit, INSERM U296, University Paris XII Hôpital Henri Mondor, Creteil 94, France

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EVALUATION OF PRESSURE CONTROLLED (PC) INVERSE RATIO VENTILATION (IRV), VOLUME CONTROLLED (VC)-IRV AND VC WITH PEEP IN THE ADULT RESPIRATORY DISTRESS SYNDROME (ADRS).

I.Vallverdú, G.Domínguez, E.Bak, A.Ortiz, M.Subirana, S.Benito, A.Net, J.Mancebo.

IRV has been described as an alternative to conventional VC in order to improve intrapulmonary gas exchange at lower peak pressures in patients with ARDS. To compare the IRV and VC we studied 6 patients with severe ADRS in the 3 following modes of ventilation, applied in random order, for at least 30 min.: 1) VC with I/E ratio = 1/2; 2) VC-IRV and 3) PC-IRV. Total positive end expiratory pressure (PEEPt), tidal volume and respiratory rate were kept constant in each ventilatory mode. A constant airflow (V) pattern was used in VC modes, and a decelerated V pattern was used in the PCIRV mode. FiO2=1 was used through out the procedures. All patients had arterial and thermodilution catheters inserted. Signals of V and airway pressure (Paw) were acquired and digitized via an IBM 55SX computer, in order to measure peak Paw (PP) and mean Paw (MP). At the end of each ventilatory period, gas exchange and haemodynamic parameters were measured. Differences between the 3 modes of ventilation were analyzed by two-way ANOVA.
Results (mean values±SEM) were as follows:

	PaO2 (mmHg)	PaCO2	PP (cmH2O)	MP	Qs/Qt (%)	PEEPt (cmH2O)	CO (L/min)
VC	116±1	37±1	37±4	16±1	33±2	9.5±.3	7.6±.8
VCIRV	137±17	36±1	29±3	17±2	30±2	9.0±.2	7.1±.7
PCIRV	107±15	36±1	25±2	19±1	33±3	9.0±.0	7.4±1
P=	0.1	0.46	<.001	0.1	0.1	0.1	0.3

There is no acute advantage in gas exchange or haemodynamics using VCIRV or PCIRV at the same level of PEEPt, and minute volume used in VC.

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Servei Med Intensiva. Hospital Sant Pau. Avda. Sant Ant. Mª Claret 167. Barcelona. (Spain)

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PRESSURE CONTROLLED VENTILATION VERSUS CONVENTIONAL CONTROLLED MECHANICAL VENTILATION WITH DECELERATING INSPIRATORY FLOW.

J Muñoz, JE Guerrero, JL Escalante, R Palomino, P Albert.

Pressure Controlled Ventilation (PCV) is a patient or time triggered, -- pressure limited, time-cycled mode of ventilatory support, characterized by a rapid rise of airway pressure with decelerating inspiratory flow -- pattern. Traditionally this thecnique has been applied in association -- with inversion of the inspiration:expiration (I:E) ratio. PCV with normal I:E ratio and Controlled Mechanical Ventilation (CMV) with constant flow have also been already compared, demonstrating a significant improvement in oxygenation and respiratory mechanics when PCV was used. We -- have conducted a prospective study to ascertain wether the advantages -- claimed for PCV are maintained when compared with the use of conventional CMV with decelerating inspiratory flow (CMV-DIF).

Ten consecutive patients with severe ARDS were studied. We analyzed the respiratory mechanics and the arterial gasometry after 60 minutes of --- standard CMV-DIF with I:E = 1:2. PCV was then initiated with equal FiO2 (0.8 ± 0.1), respiratory frequency (15 ± 2 cycles/min), PEEP (8 ± 4 cm H20) and I:E ratio. The PCV pressure was modified to obtain the same tidal volume as CMV-DIF. Sixty minutes later the same parameters of gas exchange and respiratory mechanics were again analyzed.

The PaO2 was significantly higher in PCV than in CMV-DIF (104 ± 34 vs -- 94 ± 29 mmHg, respectively, p=0.043). No modifications were found in pH, pCO2 or CO3H. The parameters of respiratory mechanics studied, including peak pressure, end-inspiratory pressure, mean pressure, intrinsic-PEEP, maximum inspiratory flow, inspiratory resistance and compliance, showed no differences.

Our study demonstrates that changing from CMV-DIF to PCV is associated - with a moderate improvement in PaO2 without changes in other ventilatory values. Increase in PaO2 in the absence of modifications in compliance - suggests that PCV's decelerating flow waveform may improve the distribution of gas within the lung. Further investigations are neccesary to determinate the clinical relevance of those findings.

Servicio de Medicina Intensiva. Hospital General "Gregorio Marañón". C/ Dr. Esquerdo 46, 1ª planta. 28007 Madrid. SPAIN.

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PRESSURE CONTROLLED INVERSE RATIO VENTILATION (PC-IRV) IN ADULT RESPIRATORY DISTRESS SYNDROME (ARDS): EARLY AND LATE CARDIORESPIRATORY EFFECTS. C.S.V. Barbas, M.B.P. Amato, F.R.T. Plastino, C.J. Fernandes Jr, N. Akamine, E. Knobel.

PC-IRV may be a useful ventilatory modality in the treatment of ARDS. The prolonged inspiratory phase coupled with positive end-expiratory pressure results in recruitment and stabilization of closed alveolar units, allowing an improvement in arterial oxygenation at lower levels of peak airway pressure, without overinflation usually present in volume control ventilation. In order to determine the early and late advantages as well as adverse cardiorespiratory effects of this kind of ventilation we prospectively studied 6 patients who met ARDS criteria. In all cases a Swan-Ganz catheter was placed and after a baseline period of 4 hours of volume control ventilation (VCV) I:E= 1:2-(Siemens-Elema-900 C) all patients were placed in PC-IRV 2:1. A full set of cardiorespiratory parameters were made at 0, 2, 12 and 48 hs. Our results (mean+ SD) are shown bellow- (* p<0.05).

	VCV	PC-IRV(2)	PC-IRV(12)	PC-IRV(48)
PIP(cmH2O)	39+7	32+5*	31+5	29+5
VE (l/min)	15+3	14+3	12+2	13+3
PaCO2(mmHg)	37+6	35+8	36+5	37+5
Pmean(cmH2O)	16+4	23+5*	24+4	22+4
Total-PEEP	10+2	14+4*	16+3	14+4
PaO2/FIO2	128+70	180+62*	252+53*	282+73*
mPAP(mmHg)	22+1	24+2	25+3	27+4*
wP(mmHg)	10+2	11+2	14+2	15+2
CI(l/min/m²)	3.6+0.6	3.5+0.5	3.4+0.7	3.6+0.3
DO2(ml/min/m²)	620+128	600+110	591+73	545+34
VO2(ml/min/m²)	147+33	124+24	110+18	86+9
O2Ext%	24+7	21+4	19+2	15+1

Our data suggest that PC-IRV 2:1 compared to VCV significantly decrease peak airway pressure for the same minute ventilatation while increasing the PaO2 along the time. mPAP significantly increase after 48 hs whithout affecting CI. All the patients could be weaned from the ventilator and the survival rate of these patients was 66%.

ICU-Hospital Israelita Albert Einstein- Av.Albert Einstein 627-10 andar-Sao Paulo-SP-Brazil.

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PRESSURE REGULATED VOLUME CONTROLLED VENTILATION WITH DIFFERENT I:E RATIOS IN COMPARISON WITH CONVENTIONAL VOLUME CONTROLLED VENTILATION IN PATIENTS SUFFERING FROM ARDS

J. Kesecioğlu[1], L. Telci[2], F. Esen[2], T. Denkel[2], K. Akpir[2], A.S. Tütüncü[2], W. Erdmann[1], B. Lachmann[1]

The effects of volume controlled ventilation (VCV) with positive end expiratory pressure (PEEP) (M1) and pressure regulated volume controlled ventilation (PRVCV) with I/E ratos of 2:1 (M2), 3:1 (M3) and 4:1 (M4) were randomly evaluated in 38 polytraumatic patients, with severe ARDS. The purpose of this study was to look for ventilator settings which provided the best gas exchange with minimal cardiovascular disturbances but avoided hyperinflation with the risk of secondary lung damage due to high peak inspiratory pressure (PIP). PaO_2 values were significantly higher in M4 (301.2±33.8 mm Hg) compared to M1 (167.3±43.6 mm Hg), M2 (235.0±32.1 mm Hg) and M3 (264.6±36.5 mm Hg) (P<0.05). PIP were significantly lower with modes M2 (34.3±4.0 cm H_2O), M3 (32.2±4.5 cm H_2O) and M4 (30.4±4.6 cm H_2O compared to M1 (47.8±10.3 cm H_2O) (P<0.05). M4 had a higher mean alveolar pressure (MAP) (27.0±3.7 cm H_2O) compared to other modes (M1= 19.5±6.1 cm H_2O; M2= 25.2±3.6 cm H_2O and M3= 26.5±4.4 cm H_2O) (P<0.05). PEEP of 14.2±3.0 cm H_2 was applied in M1. Internal PEEP values displayed by the ventilator were 8.5±1.3, 10.5±1.2 and 13.4±1.1 cm H_2O in M2, M3 and M4 respectively. M1 and M4 had significantly higher values compared to M2 and M3 (P<0.05). P defined as the difference between PIP and PEEP values was around 17 cm H_2O in M4. This was considerably lower compared to M1, M2 and M3 values wich were approximately 34, 26 and 22 cm H_2O respectively. No differences in cardiac output was measured during the application of the ventilatory modes. PRVCV with an I/E ratio of 4:1 proved to be the best mode to achieve adequate gas exchange with low PIP and P values and to avoid pulmonary complications.

Departments of Anesthesiology, [1]University Hospital Rotterdam, Dr. Molewaterplein 40, 3015 GD Rotterdam, NL and [2]Çapa University Hospital, Istanbul, TR

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CARDIORESPIRATORY EFFECTS OF PRESSURE CONTROLLED VENTILATION WITH AND WITHOUT INVERSE RATIO IN ADULT RESPIRATORY DISTRESS SYNDROME. A. Mercat, L. Graini, F. Lenique, J. Dépret, J.L. Teboul, Ch. Richard.

Pressure controlled ventilation (PC) with or without inverse ratio, is proposed as a ventilatory mode in severe ARDS but no controlled study evaluated its effects on oxygen delivery. The aim of this study was to assess the cardiorespiratory effects of PC with two levels of inspiratory to expiratory ratio (I/E) : 1/2 and 2/1 in ARDS. Ten patients (mean age 56 years, 36 to 76) suffering from ARDS (Lung Injury Score > 2.5) since 48 hours or less, were assigned in a randomized order to three ventilatory modes : volume controlled (VC) with I/E = 1/2 (VC 1/2), PC with I/E = 1/2 (PC 1/2), PC with I/E = 2/1 (PC 2/1). All patients were sedated and paralyzed. In each patient the following parameters were kept constant within all the study : FiO2 (0.8 ± 0.1), tidal volume (9.5 ± 0.7 ml/kg), respiratory rate (20.0± 0.5 /min) and total PEEP (PEEPt = PEEP + PEEPi) (11 ± 2 cm H2O). The level of PEEPt was adjusted by manipulating the level of applied PEEP. All measurements (respiratory : airway pressure, respiratory rate and tidal volume; hemodynamic : Swan-Ganz and arterial catheters) were performed after one hour. Results are expressed as mean ± SEM and compared by Anova.

	VC 1/2	PC 1/2	PC 2/1
pPaw cm H2O	38.0±1.3	34.2±1.4*	31.3±1.3**
mPaw cm H2O	16.4±0.5	17.1±0.7	21.4±0.7**
PEEP cm H2O	9.7±0.5	9.6±0.5	3.6±0.5**
PEEPi cm H2O	1.4±0.3	1.6±0.3	8.4±0.9**
Pplateau cmH2O	28.9±1.4	29.0±1.4	28.9±1.0
PaO2 mmHg	83±6	77±6	87±9
PaCO2 mmHg	45±5	43±5	39±4**
CI l/min/m2	3.7±0.2	3.6±0.2	3.3±0.2*
DO2 ml/min/m2	469±38	451±35	424±28*

pPaw : peak airway pressure, mPaw : mean airway pressure, CI : cardiac index, DO2 : oxygen delivery. * : significantly different from VC 1/2 ($p < 0.05$), ** : significantly different from VC 1/2 and PC 1/2 ($p < 0.05$).

When PEEPt is kept constant, PC fails to improve PaO2. PaCO2 is significantly reduced with PC 2/1. Peak airway pressure but not Plateau pressure is significantly reduced with PC. The rise in mPaw induced by PC 2/1 probably explains the decrease in CI and DO2 observed with this mode.

Service de Réanimation Médicale, Université Paris-Sud, Hôpital de Bicêtre 78 rue du Général Leclerc 94275 LE KREMLIN-BICETRE France.